NOVEMBER, 1925 CIRCULAR 119

AGRICULTURAL EXPERIMENT STATION
KANSAS STATE AGRICULTURAL COLLEGE
MANHATTAN, KANSAS

DEPARTMENT OF DAIRY HUSBANDRY

GROUND KAFIR AS A FEED FOR DAIRY COWS[1]

H. W. CAVE AND J. B. FITCH

TABLE OF CONTENTS

PRELIMINARY STATEMENT

Because of its drought-resistant qualities kafir has to a considerable extent replaced corn in certain sections of Kansas, and especially in the western two-thirds of the state, large acreages of kafir are grown each year. During a dry year kafir will often produce a much higher yield of grain than corn. This increase in kafir production in the drier sections of the state has a direct relation to the growth of the dairy industry. The value of kafir as a silage crop for dairy cattle has been fairly well established but its value as a grain feed is not so well known.[2] The experiments herein reported were to obtain more reliable information on the comparative value of ground kafir and corn in the grain portion of a ration for dairy cows. They consisted of a series of three similar experiments, the first being made in 1923, the second in 1924, and the third in 1925.

Judging by the digestible nutrients contained in kafir seed as compared with corn, as shown in Table I, it would appear that its feeding value was practically equal to that of corn.

1. Contribution No. 55 from the Department of Dairy Husbandry.

2. In a recent experiment this station found ground Kansas Orange sorgo seed to be practically equal to corn in the grain portion of a ration for dairy cows. See Circular 110, "Ground Sorgo Seed as a Feed for Dairy Cows," issued by the Agricultural Experiment Station, K. S. A. C., Manhattan, Kan., April, 1925.

TABLE I.—Average number of pounds of digestible nutrients in 100 pounds of grain[3]

GRAIN.	Total dry matter.	Digestible nutrients.			
		Crude protein.	Carbo-hydrates.	Fat.	Total.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Corn	89.5	7.5	67.8	4.6	85.7
Kafir	88.2	9.0	65.8	2.3	80.0

PLAN OF THE EXPERIMENTS

In each experiment the "double reversal" method of feeding was used. By this method groups of cows were fed through three experimental periods each period having a preliminary period during which all adjustments in feeds were made and the experimental period proper from which data were used in making the comparison. During periods one and three, one of the feeds to be compared was used and during period two the other feed was used. By averaging the production during the first and third periods, and comparing it with the production during the second, proper allowance is made for the natural decline in milk flow,

In each of the three experiments reported herein the experimental periods consisted of 30 days, with the first 10 days used as a preliminary period. In so far as possible cows were used which were similar in period of lactation and in length of time bred. The cows were housed in the main dairy barn, in ordinary stanchions, but were turned in a dry lot whenever the weather permitted. Special mangers were installed so that each cow's feed would be kept separate. Sufficient feed of uniform character was selected at the beginning of each trial to last throughout the experiment. The cows were milked and fed twice daily at practically uniform intervals and had access to salt and water at all times. All feeds were weighed to the cows and any uneaten portion was weighed back.

A basal ration of alfalfa hay and sorgo silage was used. In addition the cows received a grain ration consisting of four parts of the grain to be compared, two parts of wheat bran, and one part of linseed meal. In two of the experiments corn chop was used in the grain ration during periods one and three and ground kafir during period two, while in the other experiment kafir was used during periods one and three and corn during period two. The cows were fed strictly according to their requirements as shown by the Morrison standard, but any necessary adjustments in the ration were made during the preliminary periods.

Body weights were taken at 8 a. m. for three successive days at the beginning of each preliminary period, the beginning of each ex-

3. Henry, W. A., and Morrison, F. B. Feeds and Feeding. Eighteenth edition, unabridged. 770 pages. The Henry-Morrison Company, Madison, Wis. 1923. Reference: Appendix, Table III, pp. 728-9.

perimental period proper, and at the close of each experimental period. The average of the weights at the close of each experimental period was taken as representing the body weight of an animal while on a particular feed. The amount of butterfat produced was computed from an average test obtained by sampling and testing the six successive milkings in the exact center of each 20-day experimental period proper.

EXPERIMENTAL RESULTS

THE 1923 EXPERIMENT

Six cows were used in the 1923 experiment, but as one went off feed, data were used from only five. A partial description of the cows used is given in Table II.

TABLE II.—Partial description of cows in the 1923 experiment

HERD NO.	Breed.	Age, years (a).	Fresh, days (a).	Bred, days (a).	Previous lactations.
120	Holstein	12½	80	0	9
110	Holstein	5	105	0	3
136	Holstein	2¾	77	0	0
131	Holstein	3¾	98	0	1
88	Holstein	5	140	42	2

(a) At the beginning of the experiment.

Corn chop was used in the grain ration during the first and third periods of this experiment and ground kafir during the second period. As there was some decline in milk flow it was necessary to make some reduction in the grain ration at each successive period.

The live weight of each cow, the feed consumed, and the milk and butterfat production are given in Table III.

While on kafir the cows averaged a little less in body weight than while on corn but the difference was not significant. The average quantity of feed consumed on the different rations was practically the same. In the production of milk and butterfat somewhat greater differences appear. While on kafir the cows produced 44.2 pounds or 2.3 per cent less milk and 4.16 pounds or 6 per cent less butterfat than while on corn. The average per cent of butterfat in the milk while the cows were on kafir was 3.45 and while they were on corn, 3.59, a decrease on kafir of 0.14 of 1 per cent or of 3.9 per cent of the per cent on corn. (In other words, 3.45 per cent is 3.9 per cent less than 3.59 per cent.)

THE 1924 EXPERIMENT

In this experiment eight cows were used, but it became necessary to remove one before the experiment was completed, so data which could be used were secured from only seven. A brief description of the cows used is given in Table IV.

TABLE III.—Live weights, feed consumed, and milk and butterfat production of the cows during the 1923 experiment

GRAIN.	Cow No.	Av. live weight.	Total feed consumed.			Total production.	
			Grain mixture.	Alfalfa hay.	Cane silage.	Milk.	Fat.
		Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Corn chop	120	1,376	140	277	791	464.8	15.57
	110	1,597	140	300	900	437.3	14.52
	136	1,017	100	200	600	359.7	12.81
	131	1,305	120	240	720	390.1	15.10
	88	1,228	120	240	720	440.2	15.10
Average or total		1,305	620	1,257	3,731	2,092.1	73.10
Ground kafir	120	1,349	120	280	800	437.2	12.72
	110	1,594	120	300	900	384.5	12.77
	136	1,016	100	200	600	319.9	12.19
	131	1,316	120	240	720	373.0	13.09
	88	1,215	120	240	720	379.4	14.61
Average or total		1,298	580	1,260	3,740	1,894.0.	65.38
Corn chop	120	1,358	120	280	800	391.9	13.87
	110	1,601	100	298	895	349.1	11.90
	136	1,018	90	200	600	309.8	11.03
	131	1,318	100	240	720	359.2	14.33
	88	1,237	110	240	720	374.3	14.85
Average or total		1,306	520	1,258	3,735	1,784.3	65.98
Summary:							
Corn, av. I and III		1,306	570	1,258	3,733	1,938.2	69.54
Kafir, period II		1,298	580	1,260	3,740	1,894.0	65.38
Increase on kafir:							
Pounds			10.0	2.0	7.0		
Per cent			1.8	.2	.2		
Decrease on kafir:							
Pounds		8.0				44.2	4.16
Per cent		.6				2.3	6.00

TABLE IV.—Partial description of cows in the 1924 experiment

HERD NO.	Breed.	Age, years (*a*).	Fresh, days (*a*).	Bred, days (*a*)	Previous lactations.
311	Jersey	10	51	0	6
95	Holstein	5	50	0	2
89	Holstein	6	68	0	4
214	Ayrshire	14	66	0	9
55	Holstein	8	34	0	5
144	Holstein	3	26	0	1
210	Ayrshire	10	123	0	6

(*a*) At the beginning of the experiment.

During periods one and three corn chop was used in the grain ration and during period two it was replaced by ground kafir. To adjust the feed to requirements with declining milk production it was necessary to reduce the grain somewhat in period two and to reduce the grain still further and also reduce the silage in period three.

Table V shows the average live weight, the feed consumed, and the milk and butterfat produced by each cow.

TABLE V.—Live weights, feed consumed, and milk and butterfat production of the cows during the 1924 experiment

GRAIN.	Cow No.	Av. live weight.	Total feed consumed.			Total production.	
			Grain mixture.	Alfalfa hay.	Cane silage.	Milk.	Fat.
		Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Corn chop	311	861	120	180	520	340.2	17.32
	95	1,207	140	260	760	549.5	17.86
	89	1,269	160	260	800	553.0	21.40
	214	1,020	120	220	680	421.2	14.78
	55	1,249	160	240	760	603.5	17.68
	144	1,261	120	240	760	461.0	17.10
	210	1,071	120	220	720	363.6	12.05
Average or total		1,134	940	1,620	5,000	3,292.0	118.19
Ground kafir	311	865	120	180	520	289.9	15.54
	95	1,216	140	260	760	495.8	16.71
	89	1,277	140	260	800	476.4	18.58
	214	1,052	120	220	680	378.9	13.15
	55	1,217	140	240	760	526.3	14.74
	144	1,271	120	240	760	449.2	16.04
	210	1,162	100	220	720	291.8	10.77
Average or total		1,151	880	1,620	5,000	2,908.3	105.53
Corn chop	311	865	100	180	480	269.5	14.01
	95	1,201	140	240	720	474.4	15.75
	89	1,249	120	260	800	455.6	17.86
	214	1,014	100	220	640	378.6	13.02
	55	1,211	140	240	720	507.9	14.48
	144	1,271	120	240	720	426.7	14.04
	210	1,206	100	240	720	305.2	10.47
Average or total		1,145	820	1,620	4,800	2,817.9	99.63
Summary:							
Corn, av. I and III		1,139	880	1,620	4,900	3,055.0	108.91
Kafir, period II		1,151	880	1,620	5,000	2,908.3	105.53
Increase on kafir:							
Pounds		12.0			100.0		
Per cent		1.1			2.0		
Decrease on kafir:							
Pounds						146.7	3.38
Per cent						4.8	3.10

It will be noted that the body weight of the cows while on kafir was not markedly different than while on corn. The small difference shown was in favor of kafir. Equal amounts of the two grains compared were consumed by the cows and the same was true of the hay. Slightly more silage was consumed while the cows were on kafir than while on corn, but the difference was only a fraction of a pound per cow per day. The quantity of milk and butterfat produced while the cows were receiving corn was somewhat greater than that produced while they were receiving kafir. This difference of 146.7 pounds of milk amounted to 4.8 per cent and the difference of 3.38 pounds of butterfat amounted to 3.1 per cent. The average per cent of butterfat in the milk while the cows were on corn was 3.56 and while on kafir, 3.63, an increase on kafir of 0.07 of 1 per cent or of 1.9 per cent of the per cent on corn. (In other

words, 3.56 per cent is 1.9 per cent less than 3.63 per cent.) It may be observed from this that the results of this experiment were quite similar to the results of the 1923 experiment in that they were somewhat in favor of corn.

THE 1925 EXPERIMENT

Seven cows were included in the 1925 experiment and data were used from all of them. Table VI gives a brief description of the cows used.

TABLE VI.—Partial description of cows in the 1925 experiment

HERD NO.	Breed.	Age, years (a).	Fresh, days (a).	Bred, days (a).	Previous lactations.
142	Holstein	4	138	0	1
133	Holstein	5	126	0	2
18	Holstein	4	43	5	1
128	Holstein	6	98	0	2
132	Holstein	5½	160	0	2
129	Holstein	6	111	0	3
140	Holstein	4¼	148	0	1

(a) At the beginning of the experiment.

The plan of this experiment differed slightly from the plan of the other two experiments in that the ground kafir was fed during periods one and three and the corn chop during period two. Due to the decline in milk flow it was neceesary to reduce the grain ration somewhat on all the cows in period two and again on most of the cows in period three. No changes were necessary in the roughage but at times certain animals refused certain portions of their roughage and this had to be weighed back.

In Table VII will be found the average live weight, the feed consumed, and the milk and butterfat produced by each cow.

While the cows were receiving kafir their body weight was slightly greater than while on corn but the difference was less than 1 per cent so this was not considered significant. This slight difference in favor of kafir might be accounted for by the fact that the cows during the kafir periods received 5.3 per cent more grain on the average than during the corn period although the feed was adjusted to requirements as near as possible. The consumption of hay and silage was nearly uniform throughout the experiment.

In milk production the showing made on the two feeds was almost the same. The very small difference of 0.23 of 1 per cent which appeared was in favor of kafir. However, the butterfat production was in favor of corn and was more marked. While on corn the butterfat yield was 4 pounds greater than while on kafir, which is a difference of 4.2 per cent. The average per cent of butterfat in the milk while the cows were on corn was 3.38 and while on kafir, 3.23,

TABLE VII.—Live weights, feed consumed, and milk and butterfat production of the cows during the 1925 experiment

GRAIN.	Cow No.	Av. live weight.	Total feed consumed.			Total production.	
			Grain mixture.	Alfalfa hay.	Cane silage.	Milk.	Fat.
		Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Ground kafir	142	1,525	120	220	900	323.7	10.75
	133	1,374	140	240	800	363.4	12.68
	18	1,200	180	227	650	456.1	14.23
	128	1,553	200	280	900	649.1	19.73
	132	1,185	200	200	700	556.6	17.26
	129	1,290	200	237	792	579.9	16.64
	140	1,443	120	240	800	324.0	10.30
Average or total		1,367	1,160	1,644	5,542	3,252.8	101.59
Corn chop	142	1,528	100	220	900	253.4	7.91
	133	1,385	100	240	800	302.2	10.03
	18	1,196	120	220	700	453.1	16.18
	128	1,584	180	280	900	548.0	16.93
	132	1,165	180	200	700	521.8	18.68
	129	1,261	180	220	800	493.3	17.17
	140	1,425	80	240	800	256.5	8.67
Average or total		1,363	940	1,620	5,600	2,828.3	95.57
Ground kafir	142	1,564	80	220	900	189.7	6.01
	133	1,393	80	240	800	230.7	7.78
	18	1,216	120	220	800	415.4	15.61
	128	1,595	160	280	900	479.6	14.77
	132	1,186	160	200	700	465.5	15.46
	129	1,235	160	220	655	449.9	15.90
	140	1,470	60	240	800	186.4	6.00
Average or total		1,382	820	1,620	5,555	2,417.2	81.54
Summary:							
Corn, period II		1,363	940	1,620	5,600	2,828.3	95.56
Kafir, av. I and III		1,374	990	1,632	5,548	2,835.0	91.56
Increase on kafir:							
Pounds		11.00	50.0	12.0	.....	6.7	.....
Per cent		.88	5.3	.74	.....	.23	.....
Decrease on kafir:							
Pounds		.....	.....	.....	52.0	.....	4.00
Per cent		.....	.....	.....	.93	.....	4.20

a decrease on kafir of 0.15 of 1 per cent or of 4.44 per cent of the per cent on corn. (In other words, 3.23 per cent is 4.44 per cent less than 3.28 per cent.)

In general the results of the 1925 experiment were similar to the two previous years, the only difference being a slightly better showing for kafir in the production of milk than in the other experiments.

SUMMARY

In Table VIII will be found a summary of the results from the three experiments. Contained in it is the average live weight, total feed consumed, and the total milk and butterfat production of all the groups. Results are included from a total of 19 cows.

It will be noted that the live weight of the cows remained very uniform on the different rations. The difference of 7 pounds per cow was in favor of kafir but as this is a difference of only one-half of 1 per cent it is of no significance.

TABLE VIII.—Summary of data obtained in the 1923, 1924, and 1925 experiments

GRAIN.	Av. live weight.	Total feed consumed.			Total production.		Average per cent fat.
		Grain mixture.	Alfalfa hay.	Cane silage.	Milk.	Fat.	
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	
Corn chop.....	1,265	2,390	4,498	14,233	7,821.5	274.01	3.50
Ground kafir.....	1,272	2,450	4,512	14,288	7,637.3	262.47	3.44

The consumption of grain, hay, and silage was virtually the same on each of the grain rations used. In the consumption of grain the greatest difference was shown but this was only 2.5 per cent and of small importance. Differences of only a fraction of a per cent were shown in the consumption of hay and silage.

In the production of both milk and fat the corn ration had a small advantage over the kafir ration. In these experiments kafir proved 97.6 per cent as efficient for milk production and 95.8 per cent as efficient for fat production as corn. The per cent of fat in the milk was 0.06 of 1 per cent greater while the cows were receiving the corn ration.

CONCLUSIONS

With cows on a liberal ration of grain, alfalfa hay, and cane silage, three experiments failed to show any particular difference in the efficiency of corn chop and ground kafir in maintaining body weight.

A grain ration containing corn chop is somewhat superior to one containing ground kafir for the production of both milk and butterfat, but the difference is small. Cows relish a grain mixture containing ground kafir equally as well as one containing corn chop.

Substituting ground kafir for corn chop in the grain ration has no apparent effect upon the per cent of butterfat in the milk produced.

PRINTED BY KANSAS STATE PRINTING PLANT
B. P. WALKER, STATE PRINTER
TOPEKA 1925
11-1620